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MARINE CORPS OPERATIONS ANALYSIS GROUP
INFORMATION RETRIEVAL SYSTEM

By P.M. Tullier and
T.W. Mason

MCOAG Research Contribution No. 6

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MARINE CORPS OPERATIONS ANALYSIS GROUP
Center for Naval Analyses
THE FRANKLIN INSTITUTE
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CENTER FOR NAVAL ANALYSES

OF

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1. Enclosure (1) is forwarded as a matter of possible interest.

2. An information retrieval system has been developed by the Marine Corps Operations Analysis Group (MCOAG) to assist study groups at Headquarters, Marine Corps, the Marine Corps Landing Force Development Center, the Marine Corps Long Range Study Panel, and other Marine Corps activities. This research contribution describes the system in detail.

3. This information retrieval system which will include monthly accession bulletins and bibliographic searches will be fully operational in the near future when a changeover of computers is completed.

4. This research contribution represents the opinions of the authors and is distributed for research purposes and as a matter of background interest to those concerned with information retrieval for studies. It does not necessarily represent the opinion of the Center for Naval Analyses nor does it reflect official opinion of the Commandant of the Marine Corps.

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MCLnO, USA Missile Cmd., Redstone Arsenal
MCREP, ELEC COMP ANALYSIS CTR
LF ADV for MILAPP, NWL
COMPHIBLANT LnO, CMCLFDA
USACDC LnO, CMCLFDA
Canadian LnO, CMCLFDA
Royal Marine LnO, CMCLFDA
COMDTMARCORPSCOLQUANT
DIR, MCLFDC, Quantico (3)
DIR, MCEC, Quantico (2)
Chairman, Long Range Study Panel, Quantico

SECDEF
DEPSECDEF
OASD (Comptroller)
OASD (Systems Analysis)
DDR&E
DEFLOCSTUDINFOEXCH (2)
DIR, WSEG (2)
SENMARCORMBR WSEG
COMDT NATLWARCOL
COMDT AFSC
COMDT ICAF
ARPA

ADMIN, DDC (20)

SECNAV
ASSTSECNAV R&D
OPA, SECNAVSTAFFOFF
Office of the Comptroller, SECNAVSTAFFOFF

CNO

Op09M
Op91
Op93M
Op343C
Op40M
Op05W
Op07M
Op702M
Op07T
Op09B94

COMPHIBLANT
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USNAANNA
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OCRD, US Army
RAC
COMDT, Army War College
CG, USACDC
USACDC, Combined Arms Group, Ft. Leavenworth
USACDC, Combat Service Support Group, Ft. Lee
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MCOAG RESEARCH CONTRIBUTION NO. 6

Marine Corps Operations Analysis Group

CENTER FOR NAVAL ANALYSES

MARINE CORPS OPERATIONS ANALYSIS GROUP INFORMATION RETRIEVAL SYSTEM

By P.M. Tullier and
T.W. Mason

15 June 1966

Work conducted under contract NONR 3732 (00)

Enclosure (1) to
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Dated 15 June 1966

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ABSTRACT

An information retrieval system has been developed by the Marine Corps Operations Analysis Group (MCOAG) to furnish assistance to Headquarters Marine Corps (HQMC), the Marine Corps Landing Force Development Center (MCLFDC) and the Marine Corps Long Range Study Panel (LRSP). In operation of the system, a large volume of classified information is scanned by MCOAG analysts and only those items pertinent to operations research on Marine Corps problems are filtered out. Each document is then tagged with descriptors which attempt to capture essential elements of the paper. The descriptors are drawn from groupings of things, places, operational function, organizations, physical phenomena, values, processes and environments. The title of each document, source, security classification, year of publication, descriptors, the Defense Documentation Center (DDC) accession number and the secret or confidential file accession number of HQMC, Marine Corps Schools, MCLFDC or CNA are put into computer storage. Monthly accession bulletins will be produced for HQMC, MCLFDC, Marine Corps Long Range Study Panel and the MCOAG research staff. Individual requests for information from HQMC staff sections or MCLFDC project officers will be processed to retrieve documents and to produce bibliographies on demand.

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I. INTRODUCTION

The responsibilities of the Marine Corps Operations Analysis Group (MCOAG) include assisting the Marine Corps in retrieval of operations research information. Reference (a) includes among the missions of the MCOAG the following:

> "f. Compiles and publishes a monthly acquisition bulletin of studies of possible interest to Headquarters staff sections and the agencies under Coordinator, Marine Corps Landing Force Development Activities (CMCLFDA)."
>
> "g. Prepares subject bibliographies of studies for staff sections and agencies of CMCLFDA who require them using data retrieval methods and its studies data base."

This research contribution describes the information retrieval system developed by the MCOAG to carry out these missions of compiling and publishing an accession bulletin and preparing bibliographies.

II. SOURCES OF INFORMATION

As a specialized organization, the Marine Corps Operations Analysis Group is faced with the following type of information problem. The MCOAG deals with a limited assortment of problems, namely those associated with amphibious assaults. However, as an operations research group it is aware, as a matter of routine, of thousands of classified and unclassified documents which are published each month. The vast majority of these are of no interest whatsoever since they are not relevant to any of the problems encountered in an amphibious assault. The few that are of interest are often not immediately applicable, thus they must be stored, and a means provided for recalling them when necessary. The solution to this problem is, of course, some sort of filtering of these thousands of reports and then an automatic information system which will both produce a specialized accession list, i.e., one containing only documents pertinent to Marine Corps interest, and that will also retrieve answers to specific requests for information by providing printed bibliographies on any desired subject.

Information for the MCOAG Information Retrieval System is filtered from the following sources:

(a) Center for Naval Analyses (CNA)

One of the responsibilities of the Center for Naval Analyses is to maintain a library of classified operations research reports, reference (b). The Center for Naval Analyses (the present name of the Navy's original operations research organization) has been collecting operational and technical reports on naval operations research matters since April 1942. CNA's library currently contains more than 115,000 documents, mostly on microfilm, with an average input of 1,000 new reports each month. MCOAG analysts scan the daily CNA accession bulletins to filter out those reports pertinent to Marine Corps operations research.

(b) Marine Corps Headquarters (HQMC)

The MCOAG at HQMC (Code AXD) receives certain operations research material through routine HQMC routing. The Assistant Deputy Chief of Staff for Studies and HQMC project officers on cost-effectiveness studies or other operations research projects, assist the MCOAG by bringing pertinent documents to the attention of MCOAG analysts.

(c) Marine Corps Landing Force Development Center (MCLFDC)

The Marine Corps Operations Analysis Group Detachment at MCLFDC, Quantico, Virginia, receives operations research reports through routine Development Center routing. MCLFDC project officers assist MCOAG by bringing pertinent reports to the attention of MCOAG analysts. The Marine Corps Schools (MCS) Classified Control Center's monthly accession list of classified documents and the MCLFDC daily unclassified accession list are scanned by MCOAG analysts for reports pertinent to Marine Corps operations research.

(d) Defense Documentation Center (DDC)

The Defense Documentation Center for Scientific and Technical Information of the Defense Supply Agency at Cameron Station, Alexandria, Virginia, prepares a Technical Abstract Bulletin (TAB) semi-monthly. This bulletin contains abstracts of reports on research, development, test and evaluation matters written by Department of Defense agencies and their contractors. The bulletins are unclassified, but access to them is controlled to qualified DDC users, i.e., Department of Defense and other government agencies and their contractors.

The Technical Abstract Bulletin (TAB) and the TAB Index are arranged with 188 subject groups within 22 fields. (The fields are listed on page B-1.) Table I shows the use made of the DDC TAB bulletins. The amount of filtering done by MCOAG analysts to find documents on amphibious matters is shown clearly.

TABLE I

FILTERING OF TAB BULLETINS TO FIND DOCUMENTS
RELEVANT TO OPERATIONS RESEARCH ON AMPHIBIOUS MATTERS

TAB	Unclassified Documents			Classified Documents		
	Total	# Relevant	% Relevant	Total	# Relevant	% Relevant
1. TAB 65-2 15 Jan 65	434	0	0%	1398	57	4.07%
2. TAB 65-3 1 Feb 65	521	34	6.52%	1067	27	2.53%
3. TAB 65-4 15 Feb 65	452	7	1.54%	1594	65	4.07%
4. TAB 65-5 1 Mar 65	477	7	1.46%	1380	28	2.02%
5. TAB 65-8 15 Apr 65	984	9	0.9%	1423	34	2.38%
6. TAB 65-9 1 May 65	708	10	1.41%	1865	80	4.28%
7. TAB 65-10 15 May 65	754	14	1.85%	1717	88	5.12%
8. TAB 65-11 1 June 65	649	13	2.00%	1584	72	4.58%
9. TAB 65-12 15 June 65	628	15	2.38%	1562	132	8.45%
10. TAB 65-13 1 July 65	668	24	3.59%	1565	107	6.83%
Total	6275	133	2.11%	15,155	690	4.5%

Average number of unclassified documents per TAB	=	628
Average number of relevant unclassified	=	13
Average number of classified documents per TAB	=	1516
Average number of relevant classified	=	69

III. STORING INFORMATION

Once a document is designated as being of possible future interest to the Marine Corps Operations Analysis Group it must be put in the format designed for used with the computer program. A document is represented on two cards, the first containing identifying data (to be enumerated in following paragraphs) and descriptive words represented by two-letter codes, the second containing the title and report number of the document. The second card carries an asterisk in the first column for which the computer checks to ensure correct or ring. The first card (the descriptor card) is divided into the following fields:

TABLE II

THE DESCRIPTOR CARD

FIELD	CONTENTS	COLUMNS	DESIGNATOR
1	CNA Accession Number	1-6	
2	HQMC Accession Number	7-12	
3	MCLFDC or MCS Accession Number	13-18	
4	DDC Accession Number	19-24	
5	Month & Year of Entry	25-28	
6	HQMC Category	29	
7	MCLFDC Category	30	
8	Security Classification	31	1
9	Source	32-37	2
10	Year	38-39	3
11	DDC Subject Divisions	40-41	4
12	Things	42-49	5
13	Places	50-51	6
14	Operational Functions	52-59	7
15	Organizational	60-61	8
16	Physical Phenomena	62-63	9
17	Values	64-65	10
18	Process	66-67	11
19	Environment	68-71	12

Fields 1 - 4: Accession Numbers

The MCOAG system acts as an automated card file. It does not contain documents, rather it contains references as to where a document can be found. These references are the accession numbers found in the first four fields. These fields are not searched when a request is made of the system, since if the accession number is known, the document can be obtained; indeed, that is the object of the system — to make accession numbers known.

Field 5: Month and Year of Entry

This field is used only when the monthly accession list is being printed. The month and year are read into the machine and this section of the library is sorted in fields 6 and 7, see below.

Fields 6-7: HQMC Category and MCLFDC Category

These categories correspond roughly to the organizational divisions at Headquarters Marine Corps and at the Marine Corps Landing Force Development Center. When the monthly accession lists are printed the program makes two runs. First, the section of the master file being printed (determined by the month and year) is sorted by field 6, the HQMC categories. An accession list is printed with these headings and the program repeats the procedure, sorting under the MCLFDC categories. These categories are as follows:

HQMC

	Category	Of Possible Interest To:
A	Aviation	DC/S (Air)
P	Personnel	G-1
I	Intelligence	G-2
G	Ground Combat	G-3
L	Logistics	G-4
N	Naval	Policy Analysis
M	Miscellaneous R&D	DC/S (RD&S)

MCLFDC

	Category	Of Possible Interest To:
A	Aviation	Air Support Division
G	Ground Combat & Intelligence	Ground Combat Division
S	Logistics	Combat Service Support Division
F	Artillery & Naval Gunfire	Fire Support Division
V	Amphibian Vehicles	Amphibian Vehicles Division
C	Communications & Electronics	Communications & Electronics Division
W	War Games	War Games Division
P	Miscellaneous R&D	Plans and Operations Division

Field 8: Security Classification

The security classification is entered to enable requests to be made that will take into account the user's clearance. The following security classifications are used: U - unclassified, O - official use only, C - confidential, S - secret, and T - top secret. This is the first item on the descriptor card that may be subjected to a search request. The designator appearing in the last column of table II applies only to searchable fields. The field designator is needed in the search program.

Field 9: Source

A six letter abbreviation for the organization publishing the documents is put into this field. A dictionary of these source abbreviations enables the computer to print the full name of the publishing source when the accession list is printed. These sources can be searched. Appendix A contains a list of current sources.

Field 10: Year

This is the year of publication of the document. It can be searched, thus providing a means of ensuring material received is up to date.

Field 11: DDC Subject Division

These are the 22 subject divisions listed in appendix B. This field can be searched in order to receive an extremely broad bibliography.

Fields 12-19: Descriptors

As seen above, there are nine divisions of these descriptors. Words from the descriptor list (appendix B) are chosen to represent the contents of a document. It is primarily these descriptors that are searched when a bibliography is being prepared. An example of a field designator and a descriptor would be "5(SH)" where 5 is the field designator for "things" and SH is the code for ships.

A document is coded in this fashion and is stored on tape.

IV. RETRIEVING INFORMATION

With the file constructed as above we have conveniently stored a great deal of information. However, this method of storage is only a means to an end, that end being the accurate and rapid retrieval of specific information. The system is told of a need for specific information through a "query."

A query is a request by a user for all documents that are relevant to the particular subject of interest. A query is written on a single card and consists of field designators joined by the symbols "*", "+", and "-". These stand for the logical "and", "or", and "not" connectives, respectively. Formal rules for constructing queries are given in appendix C. A query can be made quite specific by using the "and" connective frequently, since the query item is satisfied only if all descriptors connected by "and" are satisfied. However, the system is used most effectively if the queries are general, consisting mostly of "or" connectives. A more general query will produce more documents, although not enough to overwhelm the user. When going through this general listing the user is able to decide from the title if the document is of use to him. This method, based on the judgment of the user, helps to overcome semantic difficulties of miscoding.

Since many queries can be handled at once with little trouble to the requestor or the computer, the requestor can try many different combinations in order to be certain that pertinent information is not missed because of mistakes in coding.

The difference in effectiveness between the general and the specific query is seen in the following example. A request was made for material concerning "speed requirements for fast amphibious ships for transporting troops. . .". To formulate the query it is necessary to translate a request into descriptors from the system dictionary in order for the query program to be run. In this case it was decided that the following descriptors be used: (1) ships (SH), (2) transportation (TN), (3) amphibian vehicle (AV), (4) amphibious (AP), (5) speed (SX). From these descriptors, four query items were made: ships or transportation, 4(SH + TN); ships or amphibian vehicles, 5(SH + AV); amphibious, 12AP; speed, 10SX. Various combinations of these items were used, employing both the "+" and "*" connectives. Table III shows the query, the number of documents retrieved, the number of relevant documents retrieved, the number of relevant documents in the system, the percentage of retrieved documents that were relevant, and the percentage of relevant documents in the system that were retrieved.

TABLE III

RETRIEVAL EFFECTIVENESS OF GENERAL AND SPECIFIC QUERIES

Query	Number retrieved	Number relevant	Total No. relevant in system	% Retrieved that were relevant	% Total relevant that were retrieved
1. (5(AV+SH))	50	19	25	38	76
2. (10SX)	6	2	25	33	8
3. (12AP)	6	3	25	50	12
4. (4(SH+TN))	32	19	25	48	76
5. (4(SH+TN)*5(SH+AV))	25	12	25	48	48
6. (4(SH+TN)*12AP)	4	3	25	75	12
7. (4(SH+TN)*10SX)	1	1	25	100	4
8. (4(SH+TN)+(5(SH+AV) +(12AP)+10SX))	63	21	25	33	84

Query number 8, ships or transportation, or, ships or amphibian vehicles, or, amphibious, or, speed, is the most general, since a document is accepted if any one of the four items is satisfied. It is this query that produced the highest number of relevant documents. It also produced the most "noise", that is, 67 percent of the documents retrieved were not relevant. Query number 7, ships or transportation, and, speed, the query with the most "signal" for which 100 percent of the documents retrieved were relevant, produced only one relevant document. It is considered more valuable for the analyst to read 63 titles and find 21 that will help, than to read one title and find that it is helpful.

V. DISCUSSION

There are several significant features of the MCOAG system which enable it to operate with low cost and with limited use of MCOAG personnel. These are discussed in the following paragraphs.

1. The use of expert judgment

A significant aspect of the MCOAG system lies in the fact that it is the analyst who is responsible for selecting documents to be included in the system library. Selection based on expert judgment gained from experience with Marine Corps operations is extremely important, for the usefulness of the system depends upon the relevance of the document library to future Marine Corps operations research problems. By employing experienced judgment the MCOAG system contradicts one of the basic assumptions made in a study conducted at M.I.T. (reference (c)).

> "At one end we eliminate all human processing beyond the merest clerical manipulation on the grounds that expert judgment, evaluation, indexing, etc., requires skills that are not ordinarily available in large numbers."

Thus this important feature, the use of expert judgment, is directly attributable to the relative small size of the system.

2. The small descriptor list

Since this list contains relatively few descriptors (275), it is easily mastered, as are the technical terms it contains. This allows a relatively inexperienced person to perform the task of coding documents. In this case it is done by one MCOAG Research Assistant, in addition to her other duties.

The small size of the list is due to the fact that it contains very few synonyms. Other systems, in an attempt to be more specific, contain many words that are closely related. This gives the abstractor a choice where none is really necessary. When there are large numbers of slightly different terms presented it is possible for one abstractor to have a favorite term for one concept. If this happens, and another person begins abstracting, she may choose a different term for the concept. This can lead to mistakes in retrieval — unless one searches for all the synonyms of one concept, thus defeating the purpose of the whole idea.

The small descriptor list does allow minimal use of available personnel, but it is open to question on the grounds that a small list is a general list and, thus, not very useful in retrieving specific documents. This objection is answered when one recalls that the library input is carefully screened to admit only documents pertinent to amphibious operations. The 275 descriptors are sufficient to cover most topics in this field. The list is open-ended in that, should new problems or new approaches to old problems be developed the list can be expanded to include appropriate descriptors. This advantage of a small, easily controllable, descriptor list is also directly attributable to the small size of the system.

3. Divided descriptor list

The eight divisions of the descriptor list might seem to be an unnecessary complication, since this means that the program must take into account several fields rather than just one labeled "descriptors". Actually, it is just the opposite for by limiting the search to one or two of the specific fields, there is a saving in machine time.

Another reason for the descriptor divisions is that they make for more uniform and complete coding. With the descriptors divided in this way the abstractor can concentrate on one field at a time, thus ording her thinking and insuring that no concepts are missed.

4. Alternatives

If one of the main advantages of the MCOAG system is its relative simplicity, then why the need for automation? This is a natural question and its answer is found in a discussion of the alternatives.

First — no retrieval system at all, the "memory" method. This has undoubtedly been satisfactory for many years in many small orginations. However, one can never be sure that something hasn't been missed, particularly if there are a few thousand documents to remember. This method can always be used, but in many situations it might not deliver all information possible, and one would never know.

Second — using a general automated system intended for many types of problems (DDC for example). This works well if the user has access to such a system and the time to wait for results. In many cases, however, there is so little contact with the retrieval process and the problems being dealt with are so specialized that the user cannot convey his exact question to the system. Even if he could, it is unlikely that the specialized topic of interest is covered fully by the content of the general system. There seems to be a contradiction here, since the MCOAG system draws a large portion of its library from DDC bulletins. However, a large number of the documents in the system do not come from DDC, thus, were the MCOAG to rely strictly on DDC, quite a few pertinent documents would be overlooked. This alternative cannot even be considered if the small organization does not have access to a system of this sort.

Third — using the card file. This method might seem reasonable, since two or three thousand documents with one card apiece would not take up that much space. However, the number of cards should be multiplied by the number of cross-indexing terms used. Thus, to employ anywhere near the number of cross-indexing terms used in the MCOAG system (15) the number of file cards might be around twenty or thirty thousand for a limited initial library of two or three thousand documents. Besides this disadvantage of large size, the card file does not allow for the publication of monthly accession bulletins, it is much more difficult to maintain, and searches must be conducted only one subject at a time, the way the computer does, but not quite as quickly or certainly.

References: (a) Marine Corps Headquarters Order 5400.12, "Marine Corps Operations Analysis Group (MCOAG): Mission, Organization, and Operations of within HQMC," 31 Aug 1965

(b) SecNav Instruction 5000.14C, "Center for Naval Analyses (CNA) and CNA Policy Council: Mission Organization and Operation of," 9 Dec 1965

(c) "The M.I.T. Technical Information Project, I. System Description," by M.M. Kessler, The Libraries, Massachusetts Institute of Technology, Cambridge, Massachusetts 2 Nov 1964

APPENDIX A

MCOAG INFORMATION RETRIEVAL SOURCES

AATB	Army Aviation Test Board, Ft. Rucker, Ala.
ACDCEC	Army Combat Development Command, Experimental Center
ACDCNG	Nuclear Group
ACRDL	Army Chemical R&D Labs, Edgewood Arsenal
ACTVN	Army Concept Team in Vietnam
AEC	Army Electronics Command, Ft. Monmouth, New Jersey
AEEL	Aeronautical Electronics and Electrical Lab.
AERDL	Army Engineers Research and Development Labs., Ft. Belvoir, Va.
AERINC	Aeronautical Radio, Inc.
AERO	Aerospace Corp.
AEROJE	Aerojet General Corp.
AEROSP	Aerospace Medical Research Labs.
AEWES	Army Engineers Waterways Experiment Station
AF	Department of the Air Force
AFA	Army Frankfort Arsenal, Philadelphia, Pa.
AFAL	Air Force Avionics Lab., Wright-Patterson AFB
AFIT	Air Force Institute of Technology - Wright-Patterson AFB
AFSAWC	Air Force Special Air Warfare Center, Eglin AFB
AFSC	Air Force Systems Command
AFSWC	Air Force Special Warfare Center, Eglin AFB
AGARD	Advisory Group for Aeronautical R&D
AIB	Army Infantry Board, Ft. Benning, Ga.
AIRARM	Aircraft Armaments, Inc.
AIRUNI	Air University
ALWL	Army Limited War Lab., Aberdeen
AMC	Army Missile Command
AMFCO	American Machine & Foundry Co.
AMRA	Army Materials Research Agency, Watertown, Mass.
AORE	Army Operational Research Establishment, U.K.
ADGC	Air Proving Ground Center, Eglin AFB
APL	Applied Physic Lab., Johns Hopkins University
ARC	Atlantic Research Corp.
ARINC	ARNIC Research Corp., Washington, D.C.
ARMA	America Bosch Arma Corp
ARMSIG	Army Signal Corps
ARMY	Department of the Army
ARO	U.S. Army Research Office
ARPA	Advanced Research Project Agency
ASQ	Attack Squadron 75 (VA-75)
ASUWE	Admiralty Surface Weapons Establishment, U.K.
ASWE	Admiralty Signals & Weapons Establishment, U.K.
ATECOM	U.S. Army Test and Evaluation Command. Aberdeen
ATRC	Army Transportation Research Command
AWSD	Advanced Warfare Systems Division

BAL	Ballistic Analysis Laboratory
BATTEL	Battelle Memorial Institute
BELL	Bell Aerosystems Co.
BENDIX	Bendix Corp.
BLACKB	Blackburn Aircraft Corp., Eng.
BOEING	Boeing Aircraft
BOOZ	Booz Allen Applied Research, Inc.
BRL	Ballistics Research Laboratory, Aberdeen, Md.
BTL	Bell Telephone Laboratories
BUSHIP	Bureau of Ships
BUWEPS	Bureau of Naval Weapons
CANDOD	Canada, Department of National Defense
CADILL	Cadillac Gage Co.
CIT	Carnegie Institute of Technology
CATHU	Catholic University
CAW	Carrier Air Wing
CDEE	Chemical Defense Experimental Establishment, Salisbury, Eng.
CDMB	Cruiser Destroyer Mine Craft Branch
CDTCVN	Combat Development and Test Center, Vietnam
CEPE	Central Experimental and Proving Establishment, Ontario
CHICAG	University of Chicago
CHRYSL	Chrysler Corp.
CNA	Center for Naval Analyses
CNO	Chief of Naval Operations
CARONE	ComCarDiv One
FIRFLT	ComFirst Fleet
COMMER	Department of Commerce, Bureau of Standards
CORNEL	Cornell Aeronautics Lab.
CORG	Combat Operations Research Group, Ft. Belvoir
CRDL	Chemical Research and Development Laboratories
DATA	Data Corp., Dayton, Ohio
DDRTE	Director, Defense Research, Test, and Engineering
DETA	Detachment 4, Research and Tech. Division, Eglin AFB
DIA	Defense Intelligence Agency
DRB	Defense Research Board, Ottawa, Ontario
DRC	Defense Research Corporation
DTMB	David Taylor Model Basin
DUNLAP	Dunlap Corp.
EDO	EDO Corp.
EWGCOR	Ohio River Division, Lab. Eng. Corps
FAA	Federal Aviation Agency
FADTC	Fleet Air Defense Training Center
FALCON	Falcon Research and Development Corp., Denver, Colorado
FARDC	Foreign Area Research Documentation Center

FMC	Food Machine Corp.
FMFLANT	Fleet Marine Force - Atlantic
FMFPAC	Fleet Marine Force - Pacific
FOSTER	Foster-Miller Associates, Inc.
GE	General Electric Company
GENDYN	General Dynamics Corp.
GWU	George Washington University
HAWKER	Hawker Siddley Ltd., Eng.
HAWB	Head Air Warfare Branch, Op-722
HCSB	Head Command Systems Branch, Op-724
HEL	Human Engineering Lab., BRL, Aberdeen, Md.
HERO	Historical Evaluation and Research Organization
HFR	Human Factors Research, Inc.
HONEYW	Honeywell Corp.
HRB	HRB-Singer, Inc.
HSWB	Head Surface Warfare Branch
HUGHES	Hughes Aircraft
HUMRRO	Human Resources Research Office
IDA	Institute of Defense Analysis
IITRK	ITT Research Institute
INFO	Information Dynamics Corp., Wakefield, Mass.
INS	Institute of Naval Studies, CNA
JHU	Johns Hopkins University
JCS	Joint Chiefs of Staff
JRA	Johnson Research Associates, Santa Barbara, Calif.
JSWG	Joint Service Working Group
JTFTWO	Joint Task Force Two
KELLET	Kellet Aircraft Corp.
LACKLA	Lackland AFB
LITTON	Litton Industries
LOCKHE	Lockheed Aircraft
LTV	Ling Tempco Vought Corp.
LUNDU	Lund University, Sweden
MARQ	Marquette Aircraft Corp.
MARTIN	Martin-Marietta Co.
MATS	Military Air Transport Service
MC	Marine Corps
MCDONN	McDonnell Aircraft
MCLFDA	Coor., M.C. Landing Force Development Activities
MCLFDC	Marine Corps Landing Force Development Center

MCOAG	Marine Corps Operations Analysis Group
MELPAR	Melpar, Inc., Falls Church, Va.
METRO	Metronics Associates, Inc.
MICH	University of Michigan
MITRE	Mitre Corp.
MOTORO	Motorola, Inc.
NAA	North American Aviation, Inc.
NADC	Naval Air Development Center, Johnsville
NAFEC	Naval Aviation Facilities Experimental Center
NASA	National Aeronautical and Space Administration
NASC	Naval Aviation Safety Center
NATC	Naval Aviation Test Center, Patuxent River, Md.
NATF	Naval Air Test Facility
NATO	North Atlantic Treaty Organization
NAVWAG	Naval Warfare Analysis Group, CNA
NEL	Naval Electronics Lab.
NMC	Naval Missile Center
NMEDFR	Navy Medical Field Research Labs.
NOL	Naval Ordnance Lab., White Oak, Md.
NOTS	Naval Ordnance Test Station, Inyokern
NPPO	Naval Program and Planning Office
NRL	Naval Research Lab.
NUSL	Navy Underwater Sound Lab.
NWC	Naval War College, Newport, R.I.
NAGONR	Naval Analysis Group, ONR
NORCO	Northrop Corp.
NWG	Naval Warfare Group
NWL	Naval Warfare Lab.
NWTC	Naval Warfare Training Command
OEG	Operations Evaluation Group, CNA
ONR	Office of Naval Research
OPTEV	Operational Test and Evaluation Force
ORBMAC	Operational Res. Branch, Maritime Air Command
ORINC	Operations Research, Inc.
PAGAPL	Planning Analysis Group APL/JHU
PHILCO	Philco Corp.
PICTIN	Picatinny Arsenal
PITTS	University of Pittsburgh
PRC	Planning Research Corp.
PREINC	Presearch, Inc.
PRINCE	Princeton University
PURDUE	Purdue University
RAC	Research Analysis Corp.
RAE	Royal Aircraft Establishment, U.K.
RAND	Rand Corp.

RANGER	USS Ranger
RAYTHE	Raytheon Corp.
RCA	Radio Corporation of America
REDSTN	Redstone Scientific Information Center
ROCKIA	Rock Island Arsenal
ROME	Rome Air Development Center
ROWLAN	Rowland Corp.
SCD	Ship Characteristic Division, Op-36
SCLEC	Signal Corps Logistics Evaluation Committee
SDC	Systems Development Corp.
SECDEF	Secretary of Defense
SECNAV	Secretary of the Navy
SEG	Systems Evaluation Group, CNA
SECWP	Systems Engineering Group, Wright-Patterson AFB
SIERRA	Sierra Corp.
SIXFLT	Sixth Fleet
SRC	Systems Research Center
SRI	Stanford Research Institute
STRIKE	U.S. Strike Command, McDill Air Force Base, Florida
SWRINS	Southwest Research Institute
SYLEDL	Sylvania Electronic Defense Lab.
TAC	Tactical Air Command, USAF
TECHNO	Technology, Inc., Dayton, Ohio
THIOKO	Thiokol Corp.
UCLA	University of California
UKFV	U.K. Fighting Vehicles R&D Establishment
UOKLA	University of Oklahoma
UPENN	University of Pennsylvania
URSC	United Research Services Corp., Burlingame, Calif.
USACDC	U.S. Army Combat Development Command, Ft. Belvoir, Va.
USAMC	U.S. Army Munitions Command, Picatinny Arsenal
USAMAT	U.S. Army Materials Command
USATEC	USATECOM
USNADC	U.S. Naval Air Development Center
USNCDL	USN Civil Engineers Lab.
UUTAH	University of Utah
VERTOL	Division of Boeing
VITRO	Vitro Labs., Silver Spring, Md.
VXFIVE	Experimental Squadron Five, OpTEvFor
VXFOUR	Experimental Squadron Four, OpTEvFor

WAL	Watertown Arsenal Labs., Mass.
WEDDER	USS Wedderburn
WESTIN	Westinghouse Corp.
WRTPAT	Systems Engineering Group, Wright-Patterson AFB
WSEG	Weapon System Evaluation Group

APPENDIX B

MCOAG INFORMATION RETRIEVAL DESCRIPTORS

4 (DDC Subject Divisions)

AC	Aeronautics
AO	Astronomy and Astrophysics
BS	Behavioral and Social Sciences
MD	Biological and Medical Sciences
CH	Chemistry
EY	Earth Science and Oceanology
EL	Electronics and Electrical Engineering
EP	Energy Conversion
MT	Materials
MA	Mathematical Sciences
ML	Mechanical, Industrial, Civil, and Marine Engineering
MH	Methods and Equipment
MS	Military Sciences
MU	Missile Technology
NV	Navigation, Communications, Detection and Countermeasures
NC	Nuclear Sciences and Technology
OR	Ordnance
PY	Physics
PP	Propulsion and Fuels
SC	Space Technology

5 (Things)

AC	Aircraft
AD	Airfield
AM	Ammunition
AV	Amphibious vehicles
AT	Antenna
AG	Armor
AY	Artillery
BA	Base
BM	Bomb
BR	Bridge
CF	Camouflage
CV	Carrier, aircraft
CN	Communications
CE	Components
CK	Computer
CW	Chemical/biological warfare
CY	Convoy
CZ	Cruiser
DC	Detection
DT	Data
DY	Decoy
DD	Destroyer
D	Drone
EQ	Equipment
EW	Electronic warfare, ECM
ES	Escort
FU	Fuels
FZ	Fuze
GM	Guided Missiles
GU	Guns
HC	Helicopters
HF	Hydrofoil
IS	Instrumentation
JE	Jet
LS	Laser
LC	Landing Craft
LG	Logistics
LB	Lubrication
MQ	Map
MN	Mine
MF	Model
MR	Mortar
NP	Nuclear Propulsion
NG	Naval Gunfire
NV	Navigation
OR	Ordnance
PH	Photography and other reproductive processes
QM	Quartermaster equipment
RA	Radio
RO	Roads
RR	Railroads
RK	Rockets
RX	Radar
SK	Snorkel
SV	STOL/VTOL
SL	Satellite
SP	Seaplane
SH	Ships and Marine Equipment
SA	Small Arms

5 (Things) (Cont'd.)

SS	Submarine
SM	Swimmer
SI	Soil
SW	Snow
TA	Terrain
TG	Target
TN	Transportation
TP	Torpedo
TV	Television
TW	Tracked Vehicles
VH	Vehicles
WH	Warheads
WP	Weapon
WV	Wheeled Vehicles
UG	Underground Structure, Tunnel

6 (Places)

FK	Africa
LK	Alaska
AZ	Antarctic/Arctic
AX	Asia
LT	Atlantic Ocean
UL	Australia
CA	Central America
CX	China
EG	England
DU	Europe
FR	France
GC	Greece
GR	Germany
KO	Indian Ocean
IA	Indonesia
IM	Iran
IL	Israel
KO	Korea
LY	Libya
MI	Mediterranean
MK	Middle East
OK	Okinawa
PK	Pakistan
PA	Pacific Ocean
PN	Panama
PI	Philippines
SB	Spain
SO	South America
SE	Southeast Asia
SU	Soviet Union
TZ	Thailand
US	United States
UC	Underdeveloped Countries
VN	Vietnam

7 (Operational Functions)

AI	Antipersonnel
AP	Amphibious
AS	Air Support
AA	Anti-aircraft
AQ	Anti-Armor
AU	Anti-Submarine
AW	Anti-Tank
AJ	Arms Control, peace
TK	Attacking
CD	Civil Defense
CO	Combat
IC	Combat Information Center
CN	Communications
CC	Command and Control
CQ	Command Relations
CI	Counter-Insurgency
CM	Countermeasures
DE	Defense
DM	Deployment
DC	Detection
DP	Data Processing
DF	Direction Finding
DR	Deterrence
EL	Electronics & Electrical Engineering
DS	Disposition
EW	Electronic Warfare, ECM
EX	Exercise
FC	Fire Control
ID	Identification
IT	Intelligence
IP	Interception
IU	Installation and Construction
IX	Interdiction
IF	Interference
LM	Limited War - Guerilla
LU	Launch
LN	Location
MM	Maintenance
MA	Mathematics
ME	Measurement

7 (Operational Functions)(Cont'd)

MO	Mobility
NE	Neutralize
NY	Navigation
OA	Operations Research
OP	Operations
PF	Pacification
PL	Patrol
PC	Psychology & Human Engineering
PM	Production & Management
PG	Propagation
RE	Reception
PT	Personnel & Training
RC	Reconnaissiance
RS	Rescue
SN	Screening
SR	Searching
SQ	Supply
WR	War
SB	Support

8 (Organizational)

AF	Air Force
AR	Army
CU	Communism
DO	Department of Defense
MC	Marine Corps
MP	Military Assistance Program
NS	Nasa
NO	Nato
NA	Navy
SD	State Department
SJ	STRICOM
TE	Table of Equipment
TO	Table of Organization
TS	Treaties

9 (Physical Phenomena)

AK	Acoustics
EO	Electromagnetic
EY	Earth Science, Oceanology
IR	Infra-red
MG	Magnetic
NC	Nuclear Science
OT	Optical
PR	Pressure
TM	Temperature
TR	Thermal
TI	Time
VS	Visual

10 (Values)

AE	Accuracy
AL	Altitude
AH	Appropriations
BU	Budget
CP	Capabilities
CS	Casualties
CR	Characteristics
CT	Cost, Economics
DH	Depth
DX	Distance
EF	Effectiveness
ED	Endurance
FQ	Frequency
HT	Height
KP	Kill Probability
LE	Lethality
PB	Probability
RL	Reliability
RQ	Requirements
SX	Speed
TX	Threat
VL	Vulnerability
WT	Weight

11 (Process)

AN	Analysis
DV	Development
DN	Doctrine
EE	Engineering
EV	Evaluation
EX	Exercise
GA	Gaming
MA	Mathematics
ME	Measurement
PX	Planning
RD	Research
SI	Simulation
SG	Strategy
SY	Study
TC	Tactics
TT	Test
TH	Theory

12 (Environment)

AI	Active
AB	Airborne
AP	Amphibious
BL	Ballistics
DA	Day
DI	Dispersion
ET	External
FT	Future
FN	Foreign
GN	Ground
HI	High
IB	Internal
JU	Jungle
LO	Low
NI	Night
PS	Passive
RN	Rain
ST	Sea-State
SC	Space
SF	Surface
SW	Snow
SZ	Summer
UW	Underwater
WX	Weather, Atmospheric Science

APPENDIX C

EXPLANATION OF PROGRAM

The MCOAG Information Retrieval Program (34-65R)

This program performs the following operations:

1. Writes the dictionary tape
2. Writes the master tape
3. Deletes entries from the master tape
4. Adds entries to the master tape
5. Queries the master tape
6. Extracts an accession bulletin
7. Lists the complete master tape
8. Translates the document descriptors.

I. DICTIONARY

The dictionary tape is composed of the security classification dictionary, the HQMC category dictionary, the MCLFDC category dictionary, and the descriptor and source dictionary. The input cards for the first three dictionaries cannot be changed without changing the program. The input cards for the descriptor and source dictionary can be changed and are of the following format:

Col. 1-6 - Descriptor or source (left justified)
Col. 7-54 - Meaning of the descriptor or source.

These descriptor or source cards need not be in a prescribed order and they may be added or removed freely. The input deck for writing the dictionary tape is formed as follows:

Blank card	
Input deck	(containing no blank cards)
DICTIONARY	(beginning with Col. 1)

The dictionary will be listed on the program output tape as the dictionary tape is written.

II. MASTER

The master tape is composed of two-card entries. The first card is the descriptor card; the second card is the report title card. The input deck is formed as follows:

Blank card

Input deck of 2-card entries

MASTER (beginning in Col. 1)

The entries will be listed on the program output tape as the master tape is written.

III. DELETE

Entries may be deleted from the master tape by listing any of the four accession numbers on a deletion card (one card per entry). The deletion card has the format:

Col. 1-6 - Accession number
Col. 7-72 - Blank

The input deck is formed as follows:

Blank card

Input deck (one card per entry)

DELETE (begin in Col. 1)

The program will list all given accession numbers which were not found on the master tape.

IV. ADD

Entries may be added to the master tape and will be placed at the end of the tape. The format of the input deck (2-card entries) is identical to that used in writing the master tape. This deck is formed as follows:

Blank card

Input deck of 2-card entries

ADD (beginning in Col. 1)

V. QUERY

The query logic used is quite simple; it is based on conditions that the requestor does or does not want the desired entries to satisfy. For example, a requestor may want all entries that deal with aircraft except those that deal with helicopters. An entry that dealt solely with aircraft would be accepted, one that dealt solely with helicopters would be rejected, and one that dealt with both aircraft and helicopters would also be rejected.

There are twelve (12) descriptor fields. Three (3) of these fields are multiple-descriptor fields. The conditions in which the requestor is interested are phrased in terms of descriptor field numbers and the desired contents of those descriptor fields. For example, aircraft and helicopters are both listed under things, field 5, a multiple descriptor field. Thus the query mentioned above would be written

(5AC) — (5HC).

A typical query might be the following:

(4AC * 5(BM*JE) *9(TM+TI)) + (3(62)) — (5HC).

The asterisk (*) stands for the logical "AND"; the plus (+), for the logical "OR"; the minus (—) for the logical "NOT".

1. The query beings in column 1 with a left parenthesis. The query can begin in no other way.
2. Since field 5 is one of the multiple descriptor fields, we see use of the "compound — AND". An entry must have both descriptors, BM and JE, in field 5. Other descriptors may also be in the field.
3. Next is an example of the "compound — OR". An entry must have either TM or TI in field 9.
4. This concludes the first condition of the query. In summary, to fulfill this condition, an entry must have AC in field 4 <u>and</u> BM and JE in field 5 <u>and</u> TM or TI in field 9.
5. Since field designators are numeric, numeric descriptors must be isolated by parenthesis.

Consider an entry containing AC in field 4, BM, JE and DE in field 5, OT in field 9, 62 in 3 and HC in field 5. The entry does not satisfy the first condition; it does satisfy the second condition; but it is rejected because it satisfied a condition that the requestor did not want to be satisfied, namely, an HC in field 5.

A query beings in column 1 and is terminated by a blank column. Comments may be written on the card after the blank column. Only one query can be written on a card and only one card is allowed per query. The query deck is formed as follows:

Blank card	
Input deck	(one card per query)
QUERY	(beginning in Col. 1)

Following are the formal rules to follow in writing queries:

1. A query is composed of query items (or conditions) which are separated by + or — and are enclosed in parenthesis. All "plus" items precede "minus" items.

   $$(\text{Item}_1) + (\text{Item}_2) - (\text{Item}_3) - (\text{Item}_4) \ .$$

2. Query items are composed of a numeric field designator followed by a single or compound field descriptor. Single numerical field descriptors or compound field descriptors must be enclosed in parentheses.

   (1U * 5(AV * AG) * 3(61) * 12(GN + UW)) .

3. A query must begin in column 1 with a left parenthesis and will terminate at the first blank column.

4. An entry is accepted if it satisfies any of the "plus" items and none of the "minus" items. An entry is rejected if it satisfies any of the "minus" items regardless of the number of "plus" items satisfied.

VI. LIST

The accession bulletin is formed by listing all entries (for a given month of entry) first under the appropriate HQMC categories and next under the MCLFDC categories. This deck is formed as follows:

Blank card	
0765	(beginning in Col. 1)
LIST	(beginning in Col. 1)

VII. LOG

After several additions and deletions have been made with the master tape, it may be necessary to obtain a new listing of the complete master tape. The data deck for this is:

Blank	
LOG	(beginning in Col. 1)

VIII. DESCRIPTOR

To aid those who code the documents, a listing of selected documents (based on month of entry) can be produced with the descriptor codes translated. This uses the dictionary tape written with the DICTIONARY provision. The data deck is:

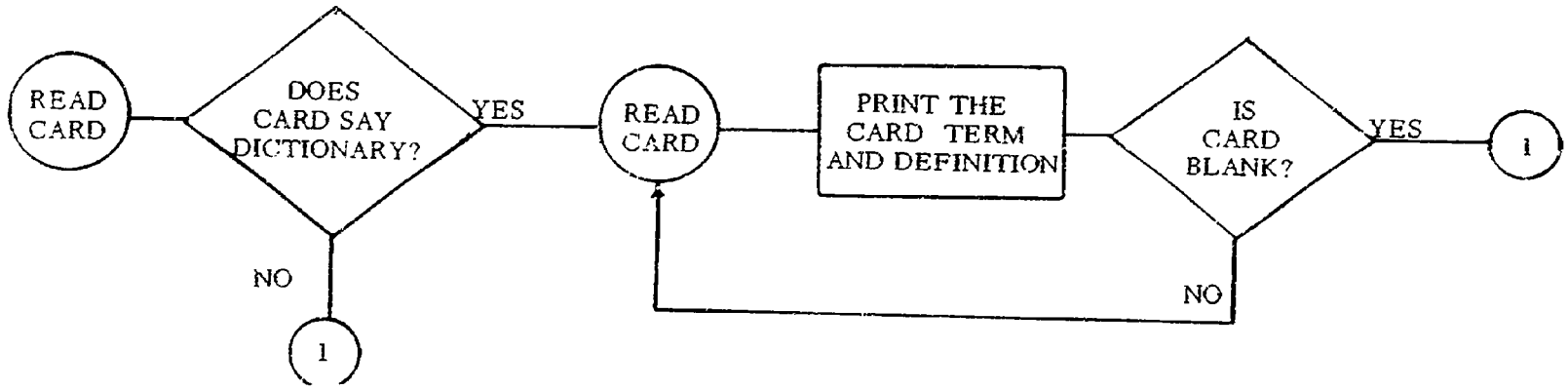
Blank	
0765	(month of entry begins in Col. 1)
DESCRIPTOR	(beginning in Col. 1)

A blank card at the end of the total data deck terminates the program.

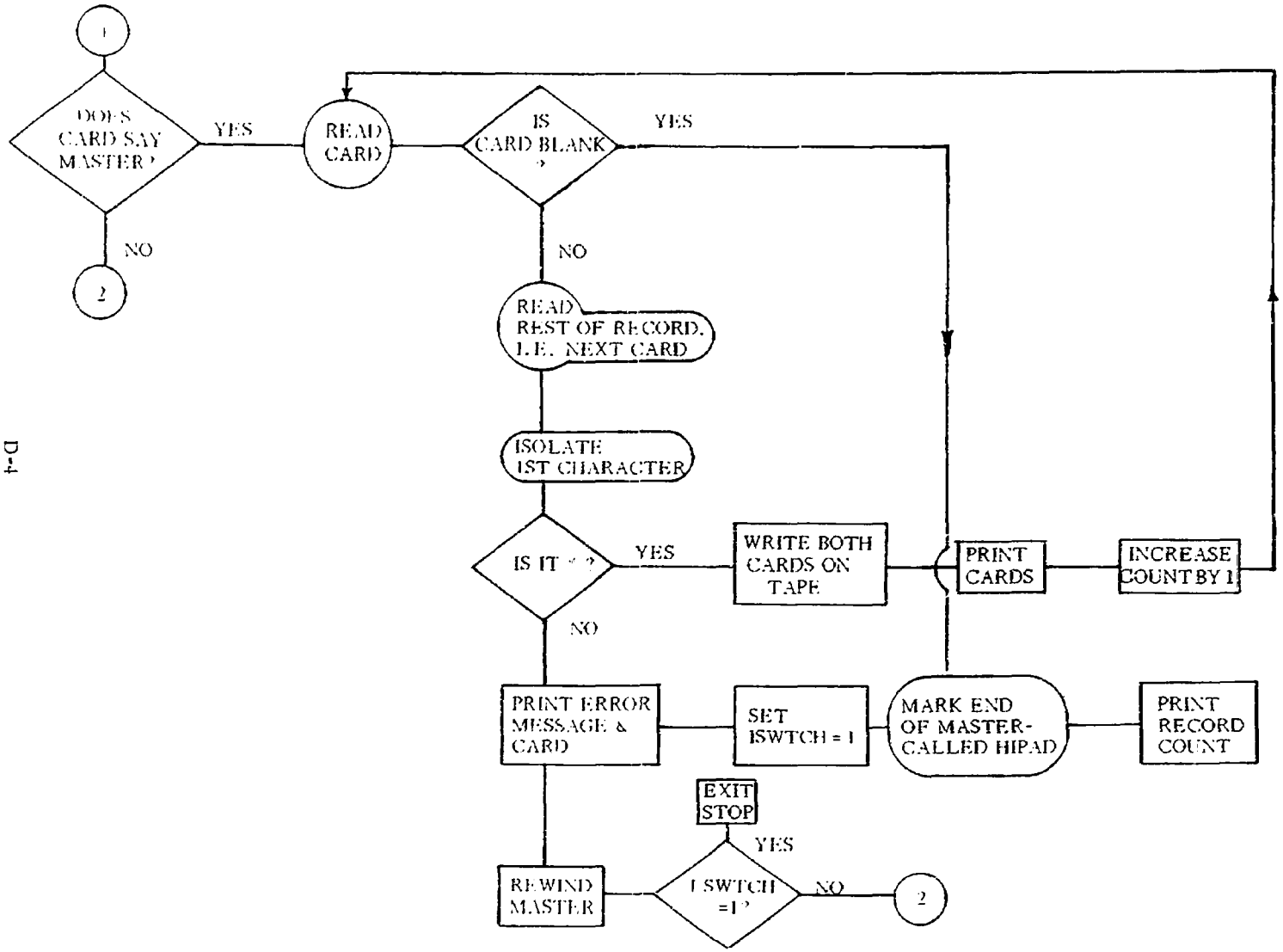
APPENDIX D

FLOW CHARTS

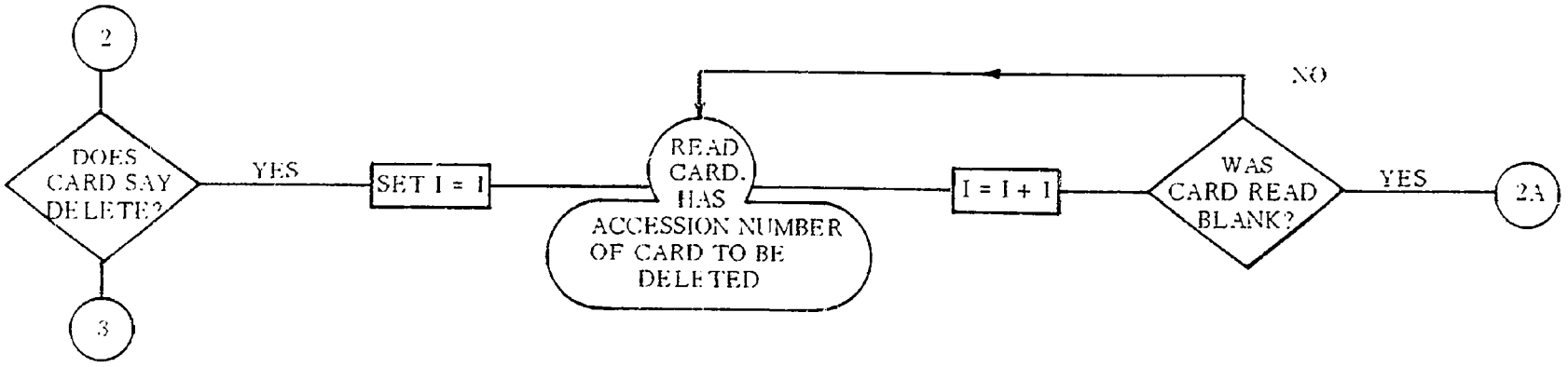
THE DICTIONARY

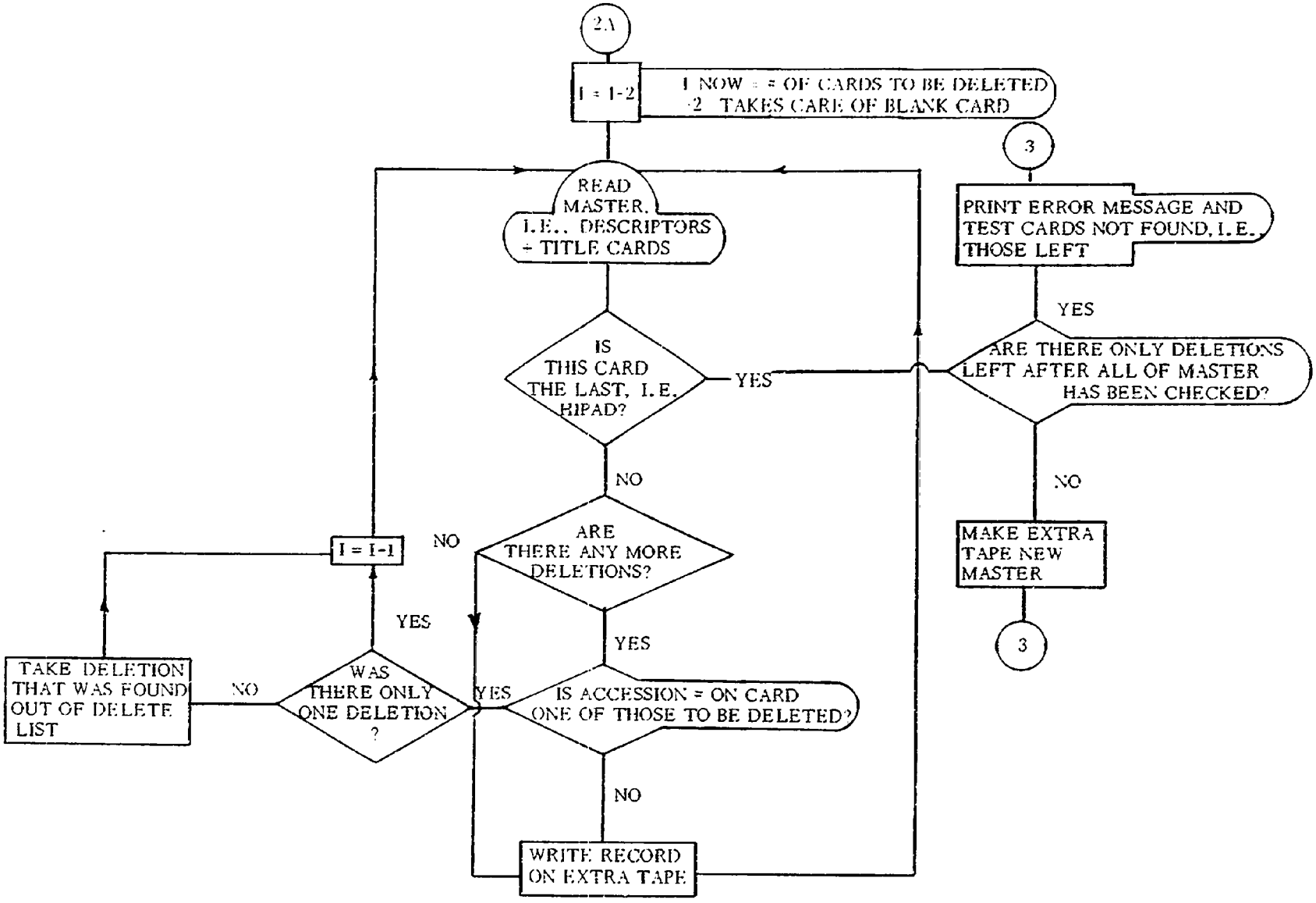


THE MASTER TAPE

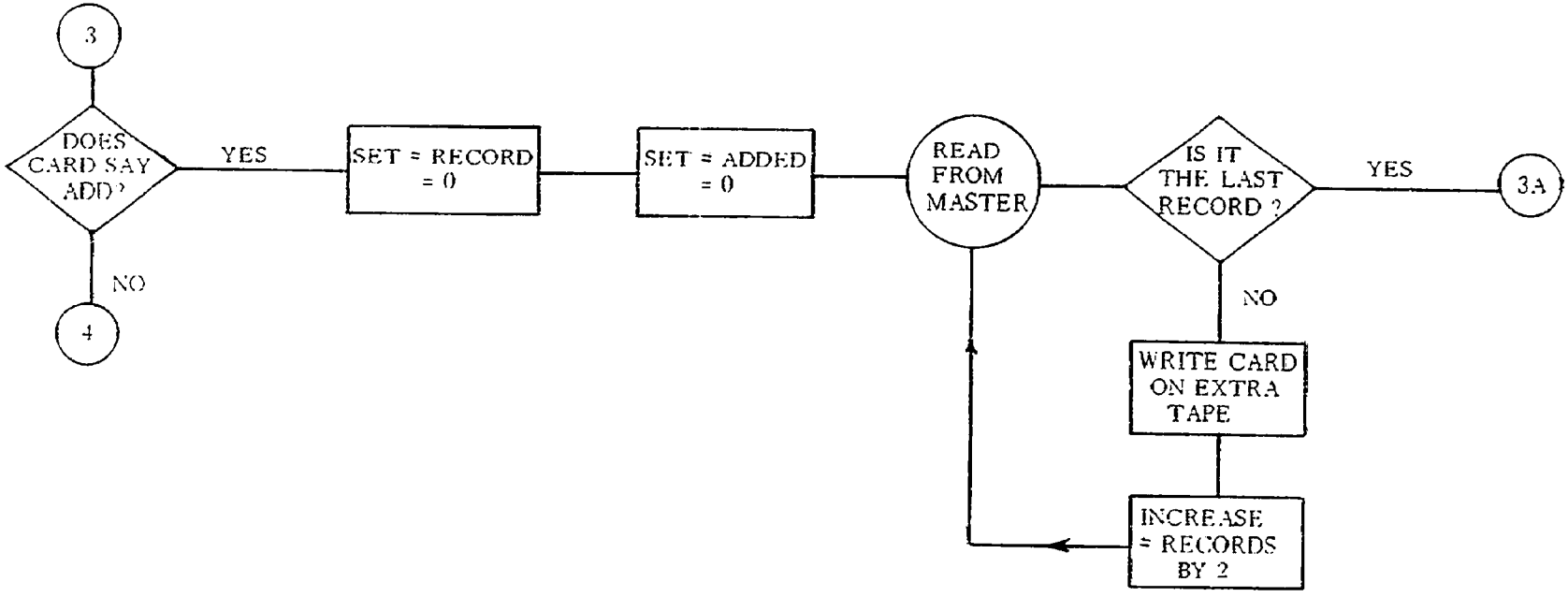


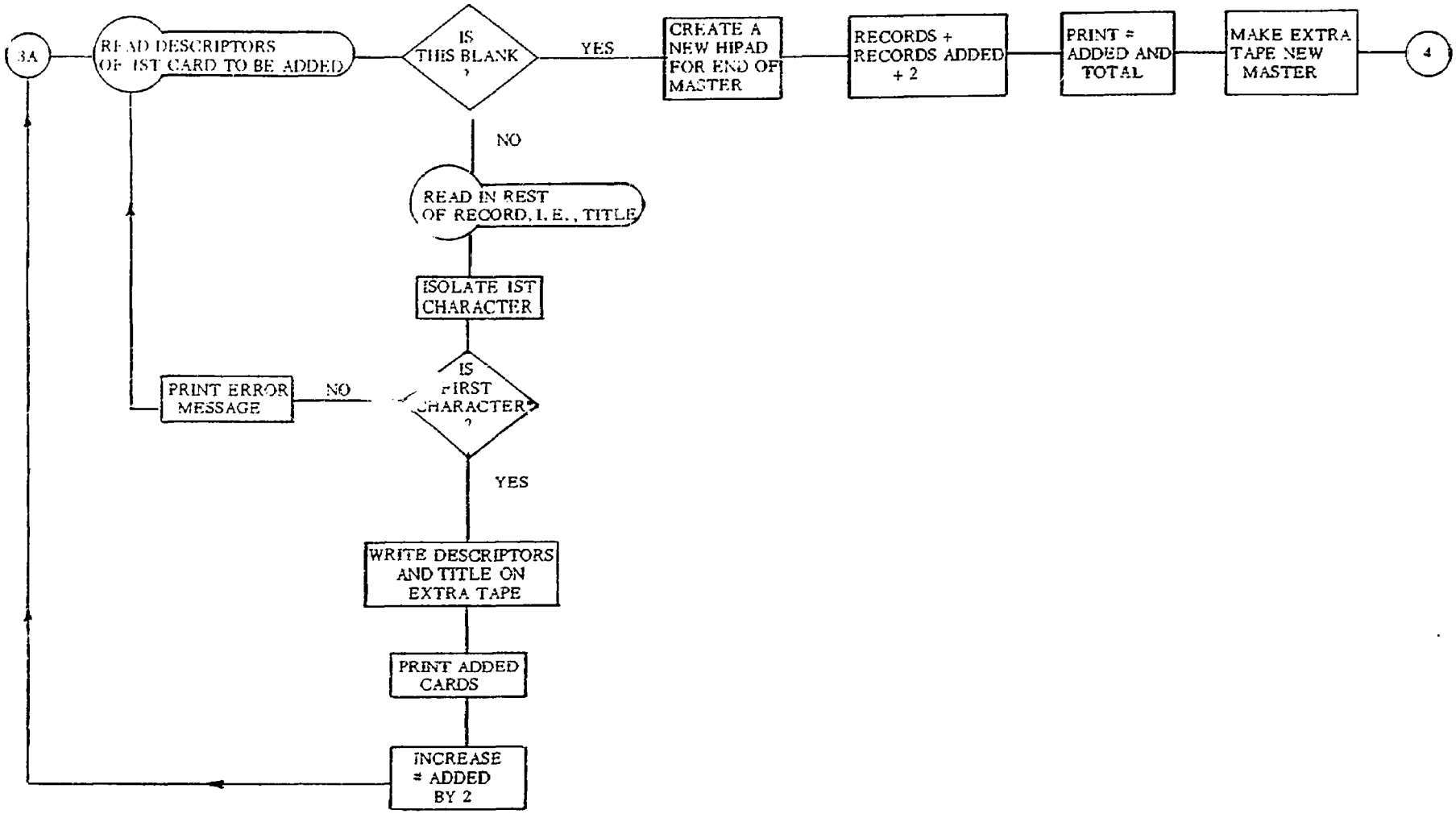
DELETING ENTRIES FROM THE MASTER TAPE



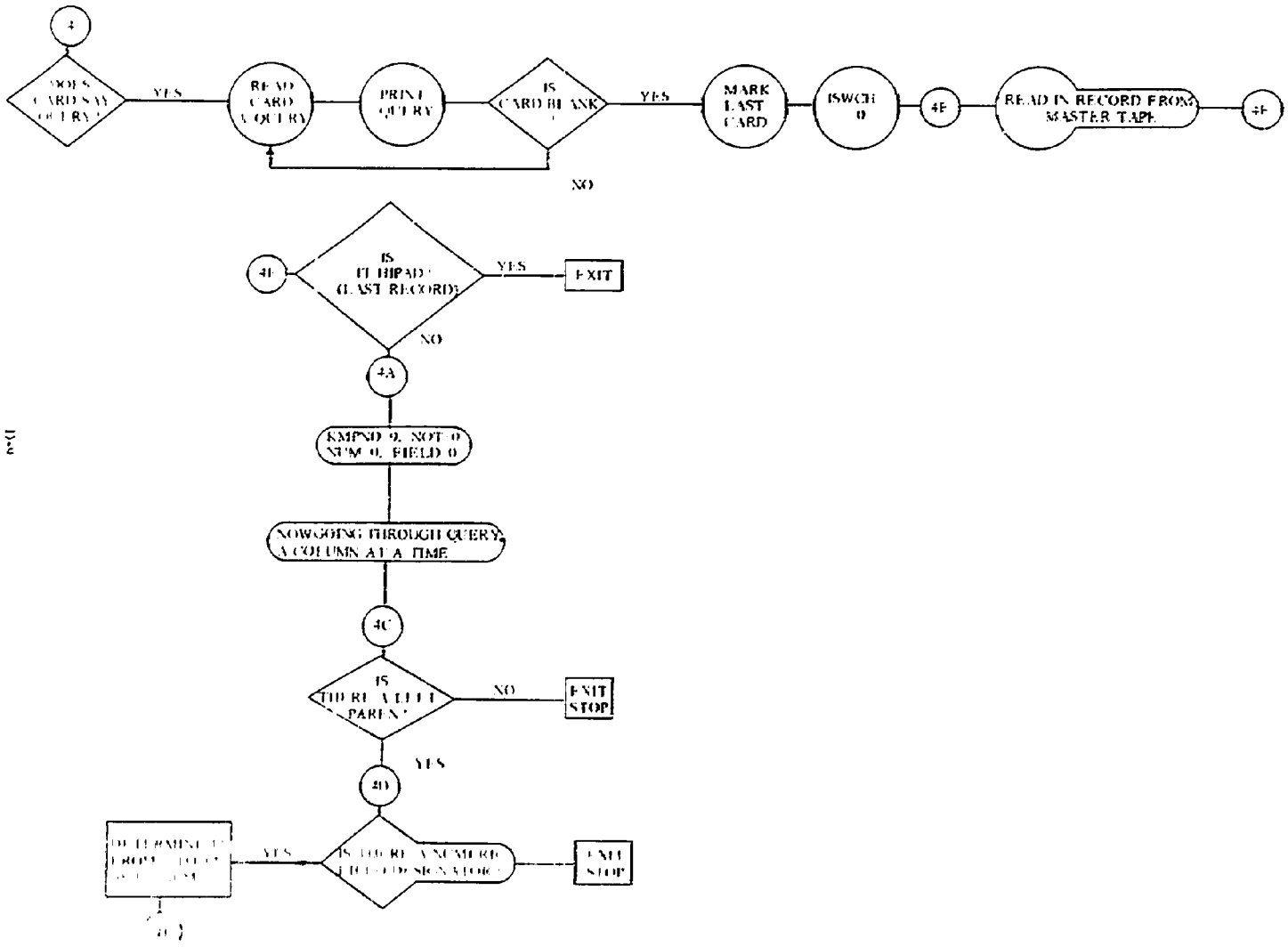

2A
I = I-2
I NOW = # OF CARDS TO BE DELETED
-2 TAKES CARE OF BLANK CARD
3
READ MASTER, I.E., DESCRIPTORS + TITLE CARDS
PRINT ERROR MESSAGE AND TEST CARDS NOT FOUND, I.E., THOSE LEFT
YES
IS THIS CARD THE LAST, I.E. HIPAD?
YES
ARE THERE ONLY DELETIONS LEFT AFTER ALL OF MASTER HAS BEEN CHECKED?
NO
NO
ARE THERE ANY MORE DELETIONS?
NO
MAKE EXTRA TAPE NEW MASTER
I = I-1
YES
YES
3
TAKE DELETION THAT WAS FOUND OUT OF DELETE LIST
NO
WAS THERE ONLY ONE DELETION ?
YES
IS ACCESSION # ON CARD ONE OF THOSE TO BE DELETED?
NO
WRITE RECORD ON EXTRA TAPE

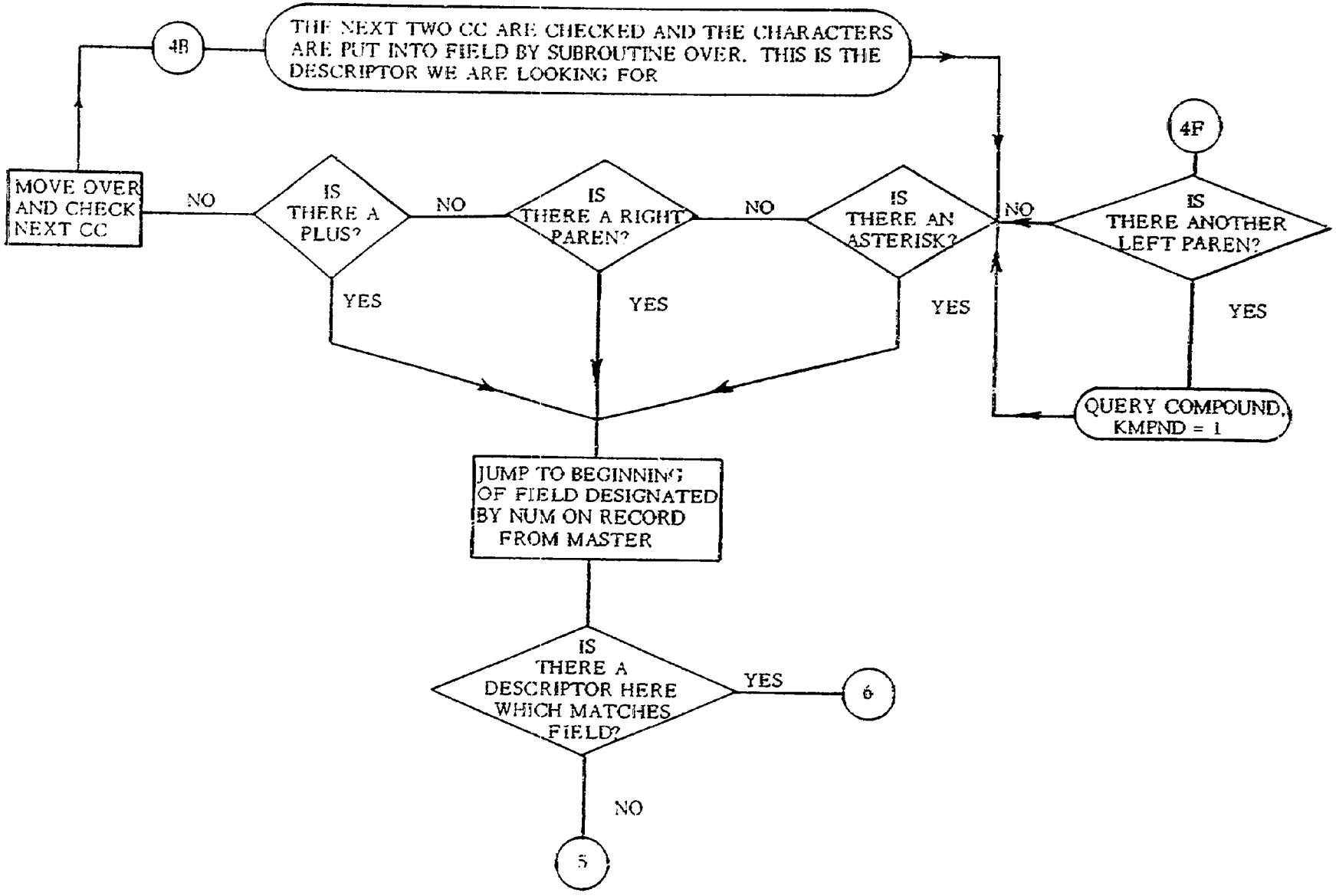
ADDING ENTRIES TO THE MASTER TAPE



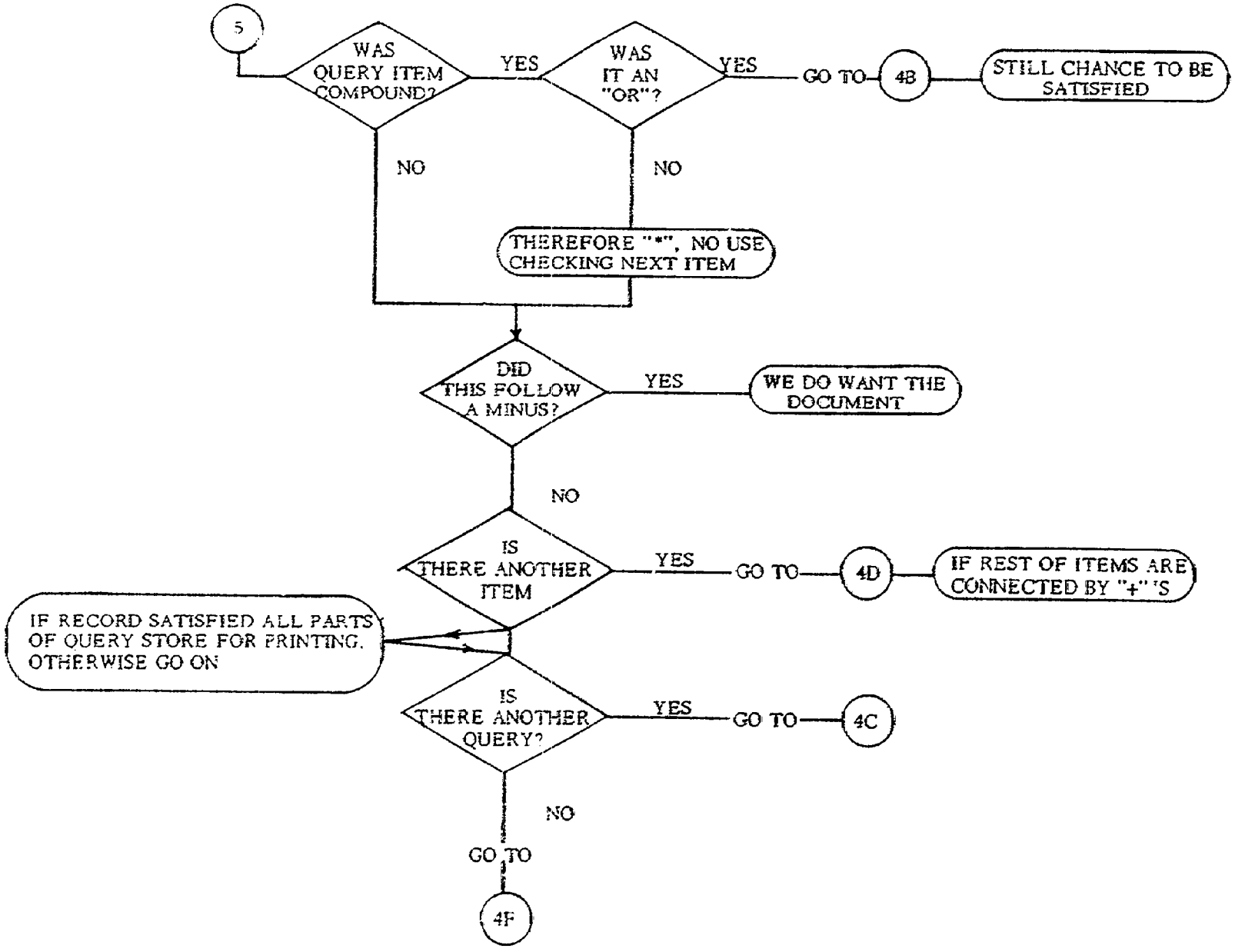

3A
READ DESCRIPTORS OF 1ST CARD TO BE ADDED
IS THIS BLANK ?
YES
CREATE A NEW HIPAD FOR END OF MASTER
RECORDS + RECORDS ADDED + 2
PRINT # ADDED AND TOTAL
MAKE EXTRA TAPE NEW MASTER
4
NO
READ IN REST OF RECORD, I.E., TITLE
ISOLATE 1ST CHARACTER
IS FIRST CHARACTER ?
NO
PRINT ERROR MESSAGE
YES
WRITE DESCRIPTORS AND TITLE ON EXTRA TAPE
PRINT ADDED CARDS
INCREASE # ADDED BY 2

SEARCH IN RESPONSE TO QUERIES

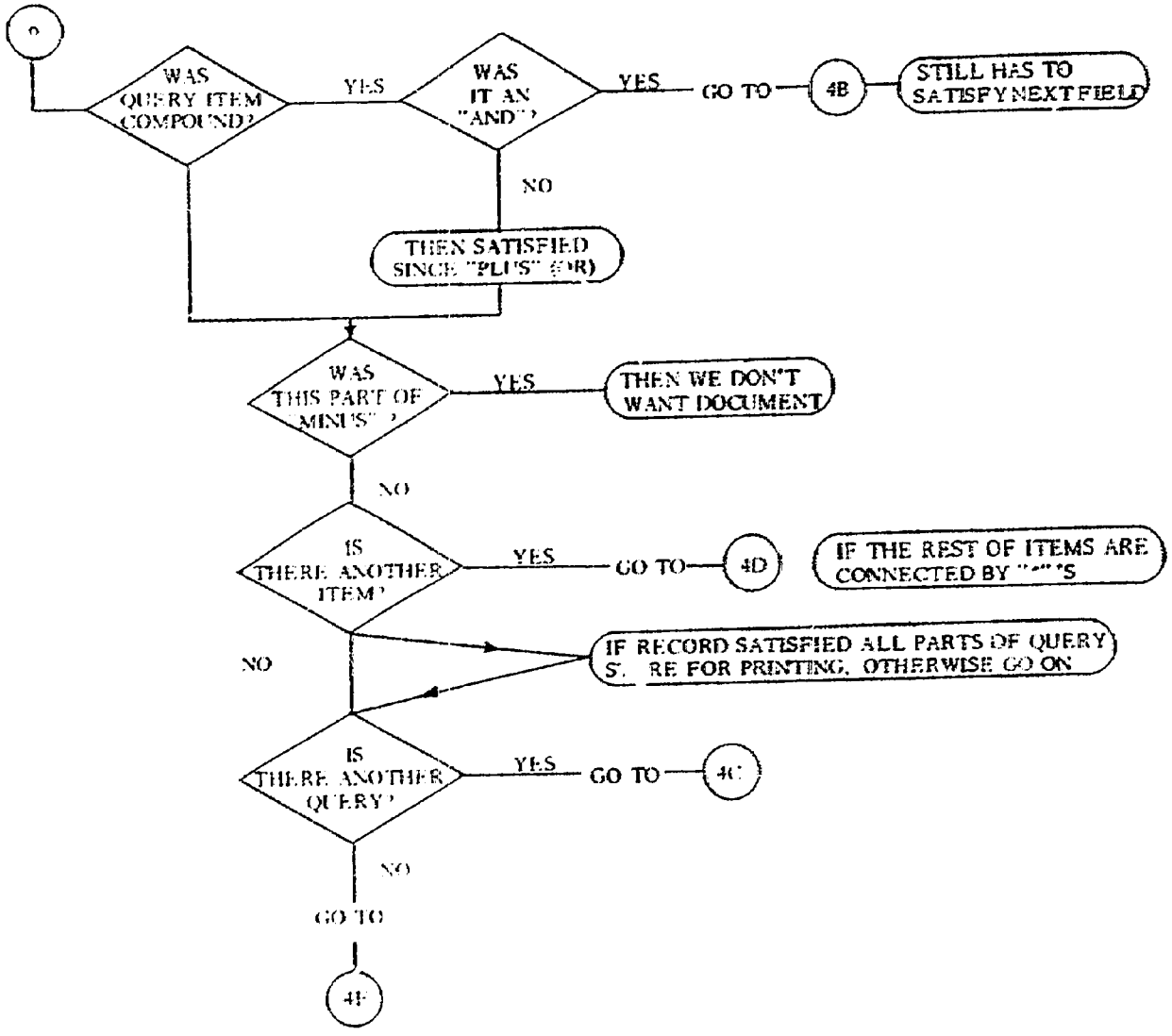



4B
THE NEXT TWO CC ARE CHECKED AND THE CHARACTERS ARE PUT INTO FIELD BY SUBROUTINE OVER. THIS IS THE DESCRIPTOR WE ARE LOOKING FOR
MOVE OVER AND CHECK NEXT CC
NO
IS THERE A PLUS?
NO
IS THERE A RIGHT PAREN?
NO
IS THERE AN ASTERISK?
NO
IS THERE ANOTHER LEFT PAREN?
4F
YES
YES
YES
YES
QUERY COMPOUND, KMPND = 1
JUMP TO BEGINNING OF FIELD DESIGNATED BY NUM ON RECORD FROM MASTER
IS THERE A DESCRIPTOR HERE WHICH MATCHES FIELD?
YES
6
NO
5

NO MATCH IS FOUND



THERE IS A MATCH



APPENDIX E

FORTRAN PROGRAM FOR THE IBM 7090

```
      COMMON ISUB,RECORD,KWEST,REC,DLIST
      DIMENSION ISUB(901),REC(500,22),DLIST(1),IDLIST(1),IREC(500,22),
     XRECORD(10001),NTRY(1),KWEST(3600),REKWST(1)
      EQUIVALENCE(ISUB,REC),(ISUB,DLIST),(ISUB,IDLIST),
     X(RECORD,ISUH(901)),     ORD,NTRY),(KWEST,RECORD(10001)),
     X(KWEST,REKWST),(REC,IREC)
      DIMENSION ARRAY(25),MATR(1)
     X,KLASS(6,4),CLASS(6,4),MCLFDC(9,6),CL(9,6),HQMC(8,6),MC(8,6),
     XDEF(500,9),IDEE(500,9),BUFR(26),DATE(2)
      EQUIVALENCE(ARRAY,MATR),(CARD,KARD),(DICT,IDICT),
     X( MSTER,AMSTER),(DELETE,LETE),(ADD,IADD),
     X(QUERY,KWERY),(ALIST,LIST),(ALOG,LOG),(BLANK,LANK),
     X(ASTER,IASTER),(TEMP,ITEMP),(ANINE,NINE),(PLUS,LUSP),
     X(PARENL,LPAREN),(PARENR,NRPARE),(AMINUS,MINUS),
     X(SHIFT, ISHIFT), (FIELD, IFELD),(DESCRI, KODE),
     X(KLASS,CLASS),(MCLFDC,CL),(HQMC,MC),(DEF,IDEE)
B     DICT=243123633146
B     AMSTER=442162632551
B     ADD=212424606060
B     DELETE=242543256325
B     QUERY=506425517060
B     ALIST=433162636060
B     ALOG=434627606060
B     DESCRI=242562235131
B     BLANK=606060606060
B     ASTER=546060606060
B      HIPAD=777777777777
B     ANINE=116060606060
B     PLUS=206060606060
B     PARENL=746060606060
B     PARENR=346060606060
B     AMINUS=406060606060
B     SHIFT=10000000000
      NREC=0
      ARRAY(25)=BLANK
      ISWCH=0
      MASTER =15
      NOTHER=16
      NAMES=7
      REWIND MASTER
      REWIND NOTHER
   50 READ 101,CARD
      IF (KARD-IDICT) 102,51,102
   51 REWIND NAMES
      PRINT 49
   49 FORMA   H1,52X24HTHE DICTIONARY    //)
   55 READ 11  , (ARRAY(J),J=1,12)
      WRITE OUTPUT TAPE NAMES,111, (ARRAY(J),J=1,12)
      PRINT 56, (ARRAY(J),J=1,11)
   56 FORMAT (23XA6,1X10A6//)
      DO 60 I=1,12
      IF (MATR(I)-LANK) 55,60,55
   60 CONTINUE
      ENDFILE NAMES
      REWIND NAMES
  100 READ 101, CARD
  101 FORMAT (A6)
  102 I  ,KARD- MSTER) 200,105,200
  105   ,  106
```

```
  106 FORMAT (1H1,51X15HTHE MASTER TAPE     ///)
  110 READ 111, (ARRAY(I), I=1, 12)
  111 FORMAT (12A6)
      DO 120 I=1,12
      IF (MATR(I)- LANK) 130, 120, 130
  120 CONTINUE
      GO TO 170
  130 READ 111, (ARRAY(I), I=13, 24)
H     TEMP=ARRAY(13)*770000000000
B     TEMP=TEMP+6060606060
      IF (ITEMP-IASTER) 140, 150, 140
  140 PRINT 141,(ARRAY(I),I=13,24)
  141 FORMAT (2X115HTHE FOLLOWING CARD WAS FOUND TO BE OUT OF SEQUENCE W
     XHILE CREATING A MASTER TAPE (THE CARD SHOULD HAVE AN ASTERISK).  /
     X47X25HTHE RUN WAS DISCONTINUED.   /24X12A6)
      ISWCH=1
      GO TO 170
  150 WRITE OUTPUT TAPE MASTER, 151, ARRAY
  151 FORMAT (12A6/13A6)
      PRINT 152, ARRAY
  152 FORMAT (24X, 12A6/24X, 12A6//)
      NREC=NREC+2
      GO TO 110
  170 DO 180 I=1,25
      ARRAY (I)=HIPAD
  180 CONTINUE
      WRITE OUTPUT TAPE MASTER, 151, ARRAY
      NREC=NREC+2
      PRINT 181, NREC
  181 FORMAT (45X, 29HTHE HI-PAD RECORD IS WRITTEN./
     X40X, I6, 34H RECORDS COMPRISE THE MASTER TAPE.)
      ARRAY (25)= BLANK
      END FILE MASTER
      REWIND MASTER
      IF (ISWCH) 190,190,1020
  190 READ 101, CARD
  200 IF (KARD-LETE) 400, 210, 400
  210 I=1
      REWIND MASTER
      REWIND NOTHER
  220 READ 221, DLIST (I)
  221 FORMAT (A6)
      I=I+1
      IF (IDLIST(I -1)-LANK) 220,230,220
  230 I=I-2
  240 READ INPUT TAPE MASTER, 151, ARRAY
      DO 250 J=1,25
      IF (ARRAY(J)-HIPAD) 260, 250, 260
  250 CONTINUE
      GO TO 350
  260 IF (I)290, 290, 270
  270 DO 280 J=1, I
      DO 280 K=1,4
      IF (MATR (K)-IDLIST(J)) 280, 300, 280
  280 CONTINUE
  290 WRITE OUTPUT TAPE NOTHER , 151, ARRAY
      GO TO 240
  300 IF (I-1) 310, 330, 310
  310 DO 320 L=J,I
```

```
      DLIST (L)=DLIST(L+1)
  320 CONTINUE
  330 I=I-1
      GO TO 240
  350 IF (I) 380, 380, 360
  360 PRINT 361
  361 FORMAT (1H1, 26X 66H THE FOLLOWING ACCESSION NUMBERS WERE NOT FOUN
     XD ON THE MASTER TAPE.      )
      DO 370 J=1, I
      PRINT 362, DLIST (J)
  362 FORMAT (57XA6)
  370 CONTINUE
  380 WRITE OUTPUT TAPE NOTHER,151,ARRAY
      ITEMP=MASTER
      MASTER=NOTHER
      NOTHER = ITEMP
      REWIND MASTER
      READ 101, CARD
  400 IF (KARD-IADD) 550, 405, 550
  405 NREC=0
      NADD=0
      PRINT 406
  406 FORMAT (1H1)
      ARRAY (25)=BLANK
      REWIND NOTHER
      REWIND MASTER
  410 READ INPUT TAPE MASTER, 151, ARRAY
      DO 420 I=1, 25
      IF (ARRAY(I)-HIPAD) 425, 420, 425
  420 CONTINUE
      REWIND MASTER
      ARRAY(25)=BLANK
      GO TO 430
  425 WRITE OUTPUT TAPE NOTHER,151,ARRAY
      NREC=NREC+2
      GO TO 410
  430 READ 111, (ARRAY(I), I=1,12)
      DO 440 I=1, 12
      IF (MATR(I)-LANK) 450, 440, 450
  440 CONTINUE
      GO TO 500
  450 READ 111, (ARRAY (I), I=13,24)
B     TEMP=ARRAY(13)*77000000000
B     TEMP=TEMP+5060606060
      IF(ITEMP-IASTER) 460, 470, 460
C     PRINT ERROR MESSAGE HERE
  460 GO TO 430
  470 WRITE OUTPUT TAPE NOTHER, 151, ARRAY
      PRINT 152, ARRAY
      NADD=NADD+2
      GO TO 430
  500 DO 510 I=1,25
      ARRAY(I)=HIPAD
  510 CONTINUE
      WRITE OUTPUT TAPE NOTHER, 151, ARRAY
      ARRAY(25)=BLANK
      NTOTAL=NADD+NREC+2
      PRINT 511,NADD,NTOTAL
  511 FORMAT (23X, I6, 53H RECORDS WERE ADDED TO THE MASTER TAPE FOR A T
```

```
2080 KMPND=1
     I=I+1
2090 IF(KWEST(I)-IASTER)2100,2310,2100
2100 IF(KWEST(I)-NRPARE)2200,2310,2200
2200 IF(KWEST(I)-LUSP) 2300,2310,2300
2300 CALL OVER (KWEST(I),MOVE,FIELD)
      MOVE=MOVE+6
     IF (MOVE-42) 2305,1020,1020
2305 I=I+1
     GO TO 2090
2310 GO TO (1,2,3,4,5,6,7,8,9,10,11,12),NUM
   1 J=5
     K=5
     GO TO 2320
   2 J=6
     K=6
     GO TO 2320
   3 J=7
     K=7
     GO TO 2320
   4 J=8
     K=8
     GO TO 2320
   5 J=9
     K=12
     GO TO 2320
   6 J=13
     K=13
     GO TO 2320
   7 J=14
     K=17
     GO TO 2320
   8 J=18
     K=18
     GO TO 2320
   9 J=19
     K=19
     GO TO 2320
  10 J=20
     K=20
     GO TO 2320
  11 J=21
     K=21
     GO TO 2320
  12 J=22
     K=23
2320 J=J+IRECRD
     K=K+IRECRD
     MOVE=0
     DO 2330 L=J,K
     IF(IFELD-NTRY(L))2330,2340,2330
2330 CONTINUE
     FIELD=0.
     GO TO 2450
2340 FIELD=0.
     IF(KMPND)2400,2400,2350
2350 IF(KWEST(I)-IASTER)2370,2360,2370
2360 I=I+1
     GO TO 2090
```

```
      XOTAL OF, I6, 9H RECORDS,    )
       ENDFILE NOTHER
       REWIND NOTHER
       ITEMP=MASTER
       MASTER=NOTHER
       NOTHER=ITEMP
       READ 101, CARD
  550  IF (KARD-KWERY) 880,560,880
  560  REWIND MASTER
       IACC=0
       PRINT 561
  561  FORMAT (1H1,55X7HQUERIES  //)
  570  I=1
  580  J=I+71
       READ 581,(KWEST(K),K=I,J)
  581  FORMAT(72A1)
       PRINT 582,(KWEST(K),K=I,J)
  582  FORMAT (24X,72A1//)
       DO 590 L=I,J
       IF(KWEST(L)-LANK) 600, 590, 600
  590  CONTINUE
       GO TO 605
  600  I=I+72
       GO TO 580
  605  LAST=I
  610  ISUB=0
       ISWCH=0
       IRECRD=1
       IR=37
  620  READ INPUT TAPE MASTER,621,(RECORD(K),K=IRECRD,IR)
  621  FORMAT (5A6,A1,A6,17A2/13A6)
       ITEMP=IRECRD+4
       DO 630K=IRECRD,ITEMP
       IF (RECORD(K)-HIPAD) 650, 630, 650
  630  CONTINUE
       ISWCH=1
       GO TO 820
  650  IND=1
  655  KMPND=0
       FIELD=0.
       I=IND
       NOT=0
       MOVE=0
       NUM=0
 2000  IF(KWEST(I)-LPAREN)2010,2020,2010
C      QUERY ITEM NOT BEGINNING WITH LEFT PAREN
 2010  GO TO 1020
 2020  I=I+1
       IF(KWEST(I))2040,2030,2030
 2030  IF(KWEST(I)-NINE)2050,2050,2040
C      QUERY ITEM W/NON-NUMERIC FIELD DESIGNATOR
 2040  GO TO 1020
B2050  TEMP=REKWST(I)*770000000000
       ITEMP=ITEMP/ISHIFT
       NUM=10*NUM+ITEMP
       I=I+1
       IF(KWEST(I))2070,2060,2060
 2060  IF(KWEST(I)-NINE)2050,2050,2070
 2070  IF(KWEST(I)-LPAREN)2090,2080,2090
```

```
 2370 IF(KWEST(I)-NRPARE)2380,2390,2380
 2380 I=I+1
      GO TO 2370
 2390 I=I+1
      KMPND=0
 2400 NUM=0
      IF (KWEST(I)-IASTER) 2410,2020,2410
 2410 IF(KWEST(I)-NRPARE)2420,2480,2420
C     ERROR-NO RIGHT PAREN FOUND
 2420 GO TO 1020
 2450 IF(KMPND)2520,2520,2460
 2460 IF (KWEST (I)-LUSP) 2475,2470,2475
 2470 I=I+1
      GO TO 2090
 2475 KMPND=0
      GO TO 2520
 2480 IF(NOT)2490,2490,2650
 2490 I=I+1
      IF(KWEST(I)-MINUS)2500,2510,2500
 2500 IF(KWEST(I)-LANK)2490,660,2490
 2510 NOT=1
      I=I+1
      GO TO 2000
 2520 NUM=0
      IF (NOT) 2530,2530,2580
 2530 IF(KWEST(I)-LUSP)2550,2540,2550
 2540 I=I+1
      IF (KWEST(I)-LPAREN) 2550,2020,2550
 2550 IF(KWEST(I)-MINUS)2560,2650,2560
 2560 IF(KWEST(I)-LANK)2570,2650,2570
 2570 I=I+1
      GO TO 2530
 2580 IF(KWEST(I)-MINUS)2600,2590,2600
 2590 I=I+1
      NOT=1
      GO TO 2000
 2600 IF(KWEST(I)-LANK)2610,660,2610
 2610 I=I+1
      GO TO 2580
 2650 IND=IND+72
      IF (IND-LAST) 655,2655,2655
 2655 IF (IACC) 620,620,2660
 2660 IRECRD=IRECRD+37
      IR=IR+37
      IACC=0
      IF (IRECRD-9990) 620,820,820
  660 IACC=1
      IF (ISUB) 670,670,680
  670 ISUB(2)=IND
      ISUB(3)=IRECRD
      ISUB=1
      GO TO 800
  680 DO 690 J=1,ISUB
      JA=2*J
      IF (IND-ISUB(JA)) 700,690,690
  690 CONTINUE
      ISUB(JA+2)=IND
      ISUB(JA+3)=IRECRD
      ISUB=ISUB+1
```

```
      GO TO 800
  700 IEND=2*ISUB+1
      K=IEND
      DO 710  J=JA, IEND
      ISUB(K+2)=ISUB(K)
      K=K-1
  710 CONTINUE
      ISUB(JA+1)=IRECRD
      ISUB(JA)=IND
      ISUB=ISUB+1
  800 IF (ISUB-275) 2650,820,820
  820 ND=ISUB(2)
      ND=ND+71
      PRINT 831, (KWEST(J), J=ND, ND)
  831 FORMAT (1H1,23X,72A1//)
      DO 860  J=1, ISUB
      K=2*J
      IF (ISUB(K)) 860,835,835
  835 IF (ND-ISUB(K)) 850,840,840
  840 K1=ISUB(K+1)
      K2=K1+36
      PRINT 801
  801 FORMAT (41X1H1,4X1H2,6X1H3,3X1H4,3X1H5,15X1H6,3X1H7,15X1H8,
     X3X1H9,2X2H10,2X2H11,2X2H12)
      PRINT 841, (RECORD(K), K=K1, K2)
  841 FORMAT(1X,5(A6,2X),A1,2X,A6,2X,17(A2,2X)/21X,13A6//)
      GO TO 860
  850 ND=ISUB(K)
      ND=ND+71
      PRINT 831,(KWEST(J),J=ND,ND)
      GO TO 840
  860 CONTINUE
      IF (ISWCH) 610, 610, 870
  870 READ 101, CARD
  880 IF (KARD-LIST) 950, 890, 950
  890 READ 891, KUTOFF,DATE
  891 FORMAT (A6,2A6)
      REWIND MASTER
      REWIND NAMES
      DO 2910 K=1,6
      READ INPUT TAPE NAMES,2901,(CLASS(K,J),J=1,4)
 2901 FORMAT (4A6)
 2910 CONTINUE
      DO 2920 K=1,8
      READ INPUT TAPE NAMES,2911,(HQMC(K,J),J=1,6)
 2911 FORMAT(6A6)
 2920 CONTINUE
      DO 2930 K=1,9
      READ INPUT TAPE NAMES,2911,(CL(K,J),J=1,6)
 2930 CONTINUE
      I=1
 2940 READ INPUT TAPE NAMES,2941,(DEF(I,J),J=1,9)
 2941 FORMAT(9A6)
      I=I+1
      IF (IDEF(I-1,1)-LANK) 2940,2950,2940
 2950 LAST=I-1
 2990 I=1
      ISWCH=0
 3000 READ INPUT TAPE MASTER, 3001, (REC(I,J),J=1,22)
```

```
 3001 FORMAT (4A6,A4,3A1,A6,A2/12A6)
 3010 DO 3020 K=1,4
      IF (REC(I,K)-HIPAD) 3024,3020,3024
 3020 CONTINUE
      GO TO 3050
 3024 IF(IREC(I,5)-KUTOFF)  3000,3025,3000
B3025 REC(J,11)=REC(J,11)*7777777777
B     REC(J,11)=REC(J,11)+600000000000
 3030 I=I+1
      IF (I-500) 3000,3000,3040
 3040 ISWCH=8
 3050 PRINT 3045, DATE
 3045 FORMAT (1H1,30X57HMARINE CORPS OPERATIONS ANALYSIS GROUP ACCESSION
     X BULLETIN    /  48X23HHEADQUARTERS EDITION -     ,2A6)
      DO 3230 K=1,7
      PRINT 3051, (HQMC(K,L),L=2,6)
 3051 FORMAT (////44X,5A6)
      DO 3220 J=1,I
      IF (IREC(J,6)-MC(K,1)) 3220,3080,3220
 3080 DO 3090 JB=1,5
      IF (IREC(J,8)-KLASS(JB,1)) 3090,3100,3090
 3090 CONTINUE
      JB=6
 3100 DO 3110 JC=1,LAST
      IF (IREC(J,9)-IDEE(JC,1)) 3110,3130,3110
 3110 CONTINUE
 3120 PRINT 3121, (REC(J,L),L=11,22),REC(J,9)
 3121 FORMAT (13A6)
      GO TO 3140
 3130 PRINT 3131, (REC(J,L),L=11,22),(DEF(JC,LA),LA=2,9)
 3131 FORMAT (20A6)
 3140 PRINT 3141,  (REC(J,L),L=1,4),(CLASS(JB,LA),LA=2,4),REC(J,10)
 3141 FORMAT (21X,4(A6,6X),3A6,6X,A6//)
 3220 CONTINUE
 3230 CONTINUE
 3300 PRINT 3301, DATE
 3301 FORMAT (1H1,30X57HMARINE CORPS OPERATIONS ANALYSIS GROUP ACCESSION
     X BULLETIN     / 26X56HMARINE CORPS LANDING FORCE DEVELOPMENT CENTE
     XR EDITION -     ,2A6)
      DO 3500 K=1,8
      PRINT 3051, (CL(K,L),L=2,6)
      DO 3490 J=1,I
      IF (IREC(J,7)-MCLFDC(K,1)) 3490,3330,3490
 3330 DO 3340 JB=1,5
      IF (IREC(J,8)-KLASS(JB,1))3340,3350,3340
 3340 CONTINUE
      JB=6
 3350 DO 3360 JC=1,LAST
      IF (IREC(J,9)-IDEE(JC,1))3360,3430,3360
 3360 CONTINUE
 3420 PRINT 3421, (REC(J,L),L=11,22),REC(J,9)
 3421 FORMAT (13A6)
      GO TO 3440
 3430 PRINT 3431, (REC(J,L),L=11,22),(DEF(JC,LA),LA=2,9)
 3431 FORMAT (20A6)
 3440 PRINT 3441,  (REC(J,L),L=1,4),(CLASS(JB,LA),LA=2,4),REC(J,10)
 3441 FORMAT (21X,4(A6,6X),3A6,6X,A6//)
 3490 CONTINUE
 3500 CONTINUE
```

```
      IF (ISWCH) 940,940,2990
  940 READ 101, CARD
      READ 101, CARD
  950 IF(KARD-LOG) 1000, 960, 1000
  960 REWIND MASTER
      PRINT 961
  961 FORMAT (1H1)
  970 READ INPUT TAPE MASTER ,151, ARRAY
      DO 980 J=1,25
      IF (ARRAY(J)-HIPAD) 990, 980, 990
  980 CONTINUE
      REWIND MASTER
      READ 101, CARD
      GO TO 1000
  990 PRINT 841, ARRAY
      GO TO 970
 1000 IF (KARD-KODE) 1020,4000,1020
 4000 DO 4010 I=1,16
      BUFR(I)=BLANK
 4010 CONTINUE
      BUFR(1)=(+6H4      )
      BUFR(2)=(+6H5      )
      BUFR(6)=(+6H6      )
      BUFR(7)=(+6H7      )
      BUFR(11)=(+6H8      )
      BUFR(12)=(+6H9      )
      BUFR(13)=(+6H10      )
      BUFR(14)=(+6H11      )
      BUFR(15)=(+6H12      )
      REWIND NAMES
      DO 5210 I=1,23
      READ INPUT TAPE NAMES, 5200, TEMP
 5200 FORMAT (A6)
 5210 CONTINUE
      I=1
 5220 READ INPUT TAPE NAMES, 5221, (DEF(I,J), J=1,9)
 5221 FORMAT (9A6)
      IF (IDEF(I,1)-LANK) 5230,5240,5230
 5230 I=I+1
      GO TO 5220
 5240 LAST=I
      REWIND MASTER
      READ 4011, KUTOFF
 4011 FORMAT (A4)
      PRINT 4012
 4012 FORMAT (1H1, 48X22HDESCRIPTOR TRANSLATION///)
      IP=0
 4020 READ INPUT TAPE MASTER, 4021, TEST, TEMP, (REC(I,J), J=1,28)
 4021 FORMAT (A6, 18X, A4, 11X, 16A2/12A6)
      IF (TEST-HIPAD) 4030,4110,4030
 4030 IF (ITEMP-KUTOFF) 4020,4040,4020
 4040 PRINT 4041, (REC(I,J), J=17,28)
 4041 FORMAT (24X, 12A6)
      DO 4090 I=1,16,2
      K=I+1
      DO 4050 L=1,LAST
      IF (IREC(I,1)-IDEF(L,1)) 4050,4060,4050
 4050 CONTINUE
      L=LAST
```

```
      PRINT 4051
4051  FORMAT (50X20HUNDEFINED DESCRIPTOR)
4060  DO 4070 LA=1,LAST
      IF (IREC(1,K)-IDEE(LA,1)) 4070,4080,4070
4070  CONTINUE
      PRINT 4051
      LA=LAST
4080  PRINT 4081, BUFR(1), (IDEE(L,J), J=2,9), BUFR(K), (IDEE(LA,J), J=2
     X,9)
4081  FORMAT (9X,A2,1X,8A6,3X,A2,1X,8A6)
4090  CONTINUE
      IP=IP+1
      IF (IP-4) 4020,4100,4100
4100  IP=0
      PRINT 4101
4101  FORMAT (1H1)
      GO TO 4020
4110  REWIND MASTER
1020  PRINT 1021, MASTER
1021  FORMAT (1H1,40X34HTHE MASTER TAPE IS ON LOGICAL UNIT,  I3)
      CALL ENDJOB
      END
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It is highly desirable that the abstract of classified reports be unclassified. Each paragraph of the abstract shall end with an indication of the military security classification of the information in the paragraph, represented as *(TS), (S), (C), or (U)*.

There is no limitation on the length of the abstract. However, the suggested length is from 150 to 225 words.

14. KEY WORDS: Key words are technically meaningful terms or short phrases that characterize a report and may be used as index entries for cataloging the report. Key words must be selected so that no security classification is required. Identifiers, such as equipment model designation, trade name, military project code name, geographic location, may be used as key words but will be followed by an indication of technical context. The assignment of links, roles, and weights is optional.

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